

Pavement Preservation Sub-Group on Strategy Selection & Evaluation

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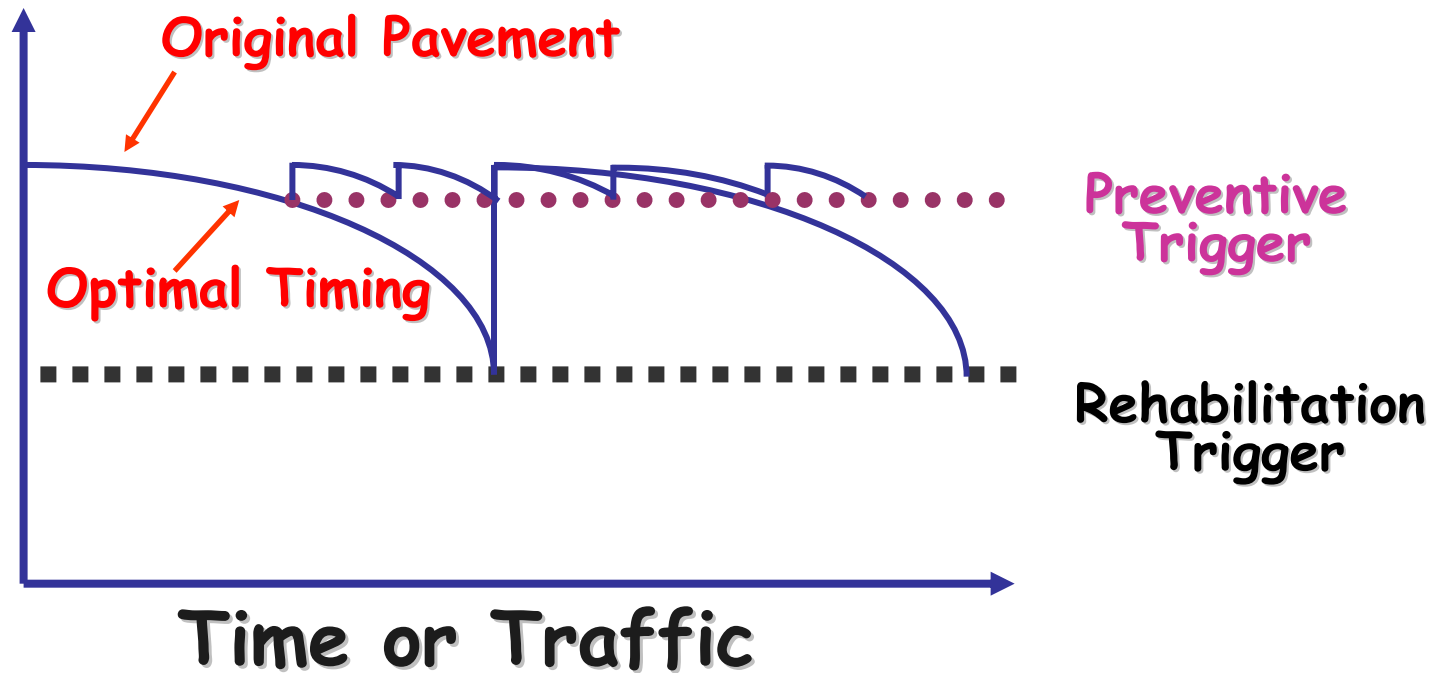


Pavement Preservation (PP) – What is it?

- Sum of all activities to provide and maintain serviceable roadways
 - Corrective & Preventive Maintenance (30mm)
 - Minor & Major Rehab (CAPM)
- SHOPP delay is pavement preservation

Pavement Preservation Concept

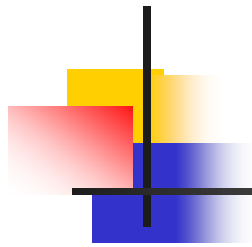
Condition





PPTG- Sub-group on Strategy Selection & Evaluation

- Overall Goals
- Work Activities
- Approach for selecting maintenance treatments
- LCCA approach
- Training Recommendations
- Summary



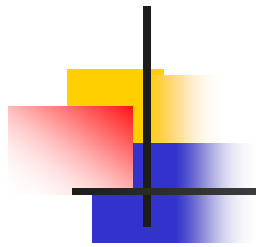
Overall Sub-group Goals

- Verify when and where to use various PP strategies based on current pavement condition data
- Show the cost effectiveness for the various strategies based on LCCA
- Provide training recommendations



Work Activities - General Scope

- Limit initial work to implemented Caltrans strategies
- Identify costs for each strategy (make sure we know what is included in the cost data)
- Identify when and where a particular strategy is appropriate and most cost effective



Typical Caltrans Treatments

AC

- Seals (Fog, Slurry, Chip)
- Crack Seal/Fill
- Micro-Surfacing
- Thin HMA Overlays
- Bonded Wearing Course
- Surface recycling

PCC

- Crack & Joint Seal
- Partial & Full Depth Repair
- Under-sealing
- Dowel Bar Retrofit
- Diamond Grinding & Grooving

MTAG- www.dot.ca.gov/hq/maint/MTA_guide.htm



Benefits of PP Treatments

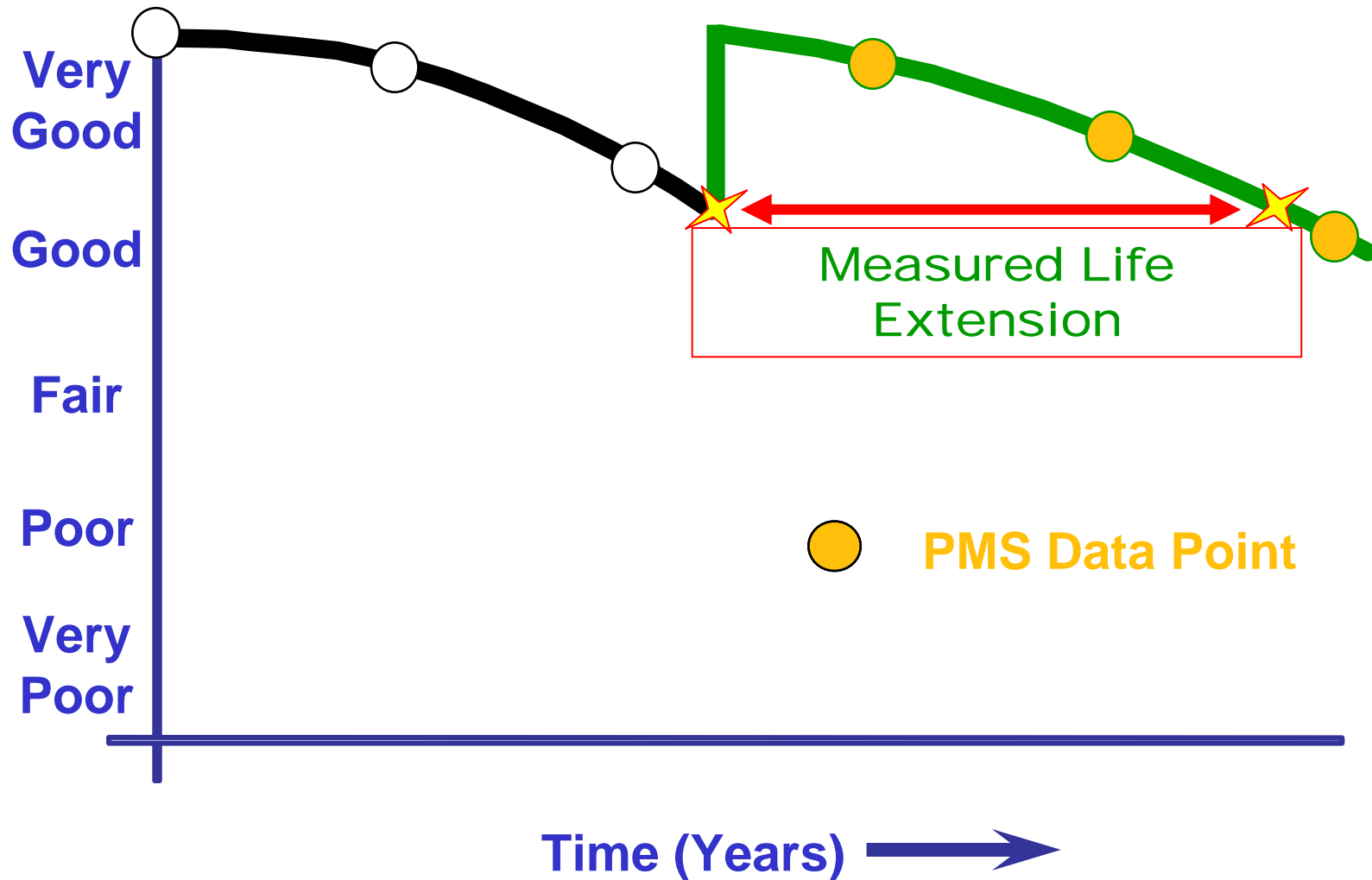
- Life Extension of the existing pavement
- Reduced noise, depending on the treatment
- Improved ride quality
- Improved skid resistance and safety (reduced splash & spray)
- Reduce user delays



Life Extension

- Definition
- Factors affecting life extension
 - Condition of existing pavement
 - Climate
 - Traffic
 - Timing of treatment
- Validation of life extension

Definition of Life Extension





Tools to Validate life extension

- Pavement condition-Type, extent and severity of distress
- Condition prior to treatment
 - At time of selection
 - At time of construction
- Condition after construction
 - Baseline
 - At various intervals
- For PP treatments, the acceptable level of existing distress should be small



Selecting Maintenance Treatments- The Caltrans approach

- **Factors considered**
 - Existing pavement condition
 - Traffic
 - Climate
 - Geography/Topography



1st Caltrans Approach- MTAG (flexible pavements only)

- evaluates applicability of various CT PP treatments
- based upon existing pavement condition and environmental factors
- Developed in 2003

MTAG Version 2003

Treatment	Pavement Condition										Parameters																
	Ravelling	Oxidation	Bleeding	Rutting		Cracking					Climate				Traffic Volumes			Nights/Cold	Stop Points	Urban	Rural	High Snow Plow Use	Cost Per Lane Mile	Life Expectancy (years)	Life Cycle Cost (\$/year)		
				<1/2"	>1/2"	Alligator B			Longitudinal	Transverse	Desert	Valley	Coastal	Mountains	adt<5000	adt<5000-30000	adt>30000										
						0 to 10%	10 to 20%	20 to 30%																			
Crack/Joint Seal																											
Emulsion	N	N	N	N	N	F	P	N	F	F	G	G	G	G	G	G	G	N	G	G	G	G	2,500	1 to 2	1,70		
Modified (Rubber)	N	N	N	N		G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	2,500	2 to 3	1,00		
Low Modulus (Polymer & Asphalt)																											
Fog Seal (See note 1)	F	G	N	N	N	F	P	N	P	P	G	G	G	G	F	N	N	P	F	G	G	F	4,500	1	4,50		
Rejuvenator (See note 1)	G	G	N	N	N	F	N	N	N	N	G	G	G	G	G	F	N	N	N	G	G	F	4,500	2 to 4	1,50		
Slurry Seals																											
Type II (See note 2)	F	G	N	N	N	F	N	N	N	N	G	G	G	F	G	G	G	P	G	G	G	P	13,000	3 to 4	3,70		
Type III	G	G	N	F	N	F	P	N	N	N	G	G	G	F	G	G	G	N	G	G	G	P	13,000	3 to 4	3,70		
Microsurfacing																											
Type II (See note 2)	F	G	N	G	N	F	N	N	N	N	G	G	G	G	G	G	G	F	G	G	G	F	16,000	3 to 4	4,50		
Type III	G	G	N	G	G	F	P	N	N	N	G	G	G	G	G	G	G	F	G	G	G	F	16,000	3 to 4	4,50		
Chip Seal																											
PME – Med. Fine	G	G	N	F	N	G	F	N	P	P	G	G	F	F	G	G	N	N	P	P	G	P	6,500	3 to 5	1,60		
PME – Medium	G	G	N	F	N	G	F	N	P	P	G	G	F	F	G	N	N	N	P	P	G	F	6,500	3 to 5	1,60		
PMA – Medium	G	G	N	F	N	G	F	P	P	P	G	G	G	G	G	G	N	G	P	P	G	F	12,500	4 to 5	2,80		
PMA – Coarse	G	G	N	F	N	G	F	P	P	P	G	G	G	G	G	N	N	G	P	P	G	G	12,500	4 to 5	2,80		
AR – Medium	G	G	N	F	N	G	G	F	P	P	G	G	G	G	G	G	N	G	P	P	G	F	20,000	4 to 6	4,00		
AR – Coarse	G	G	N	F	N	G	G	F	P	P	G	G	G	G	G	N	N	G	P	P	G	G	20,000	4 to 6	4,00		
PM Alternative																											
Conventional OGAC	G	G	P	P	N	G	F	N	P	P	G	G	G	G	G	G	G	P	G	G	G	O	19,500	3 to 4	5,60		
PBA OGAC4	G	G	P	P	N	G	F	N	P	P	G	G	G	G	G	G	G	F	G	G	G	P	25,000	4 to 5	5,60		
AR (Type O)	G	G	P	F	N	G	G	F	P	P	G	G	G	G	G	G	G	P	G	G	G	P	28,000	4 to 6	5,60		
Thin Blanket ACOL																											
Conventional	G	G	P	G	G	G	G	F	P	P	G	G	G	G	G	G	G	G	G	G	G	G	20,000	3 to 5	5,00		
PBA	G	G	P	G	G	G	G	G	F	F	G	G	G	G	G	G	G	G	G	G	G	G	25,000	3 to 6	5,60		
R (Type G)	G	G	P	G	F	G	G	G	G	G	G	G	G	G	G	G	G	F	G	G	G	G	30,000	5 to 8	4,60		
Digouts	P	P	G	N	G	N	N	G	P	P	G	G	G	G	G	G	G	G	G	G	G	G	19,000	5 to 8	2,90		
G – Good Performance F – Fair Performance P – Poor Performance N – Not Recommended																											
Note: 1. Generally used on shoulders, low volume roads, and parking areas. Should not be placed on traveled way by contract until further notice. 2. Generally used on shoulders, parking areas, and locations where a less aggressive surface texture is desired.																											

Figure 3: Caltrans Maintenance Treatment Matrix (5)



2nd Caltrans Approach- 2004 Maintenance Directive

- Guidelines for Successful Maintenance Treatments
- Basis for CT Major Maintenance Program
 - annual contract maintenance program
 - evaluated applicability of various CT PM's
 - comparison based upon pavement condition and environmental factors
 - evaluates applicability based upon type of distress condition as well as extent of cracking

Maintenance Directive 2004

GENERAL GUIDELINES FOR EFFECTIVE MAINTENANCE TREATMENTS

Treatment	Sealing	Sealant	Blinding	Traffic		Climate				Traffic Volume			Night	Cold	Slip Points	Surface	Road	High Speed H/W	Cost per Year	Life expectancy (years)	Life Cycle Cost (\$/Year)
				<400"	>400"	Drivell	Traffic	General	Highway	<1000	1000-5000	>50,000									
Crack/Fill Seal																					
Emulsion	H	H	H	H	H	G	G	G	G	G	G	G	H	H	G	G	G	G	4,500	11x2	3,000
Modified (Rubber)	H	H	H	H	H	G	G	G	G	G	G	G	G	G	G	G	G	G	4,500	21x3	1,000
Pug Seal (See note 1)	F	G	H	H	H	G	G	G	G	F	H	H	H	F	F	G	G	F	7,000	1	4,500
Rejuvenator (See note 1)	G	G	H	H	H	G	G	G	G	G	F	H	H	H	H	G	G	F	7,000	21x4	2,333
Slowing Seals																					
Type II (See note 1)	F	G	H	H	H	G	G	G	F	G	G	G	H	F	G	G	G	P	13,000	31x4	3,714
Type III	G	G	H	F	H	G	G	G	F	G	G	G	H	H	G	G	G	P	13,000	31x4	3,714
Microseal Sealing																					
Type II (See note 2)	F	G	H	F	P	G	G	G	G	G	G	G	G	F	G	G	G	H	30,000	31x4	8,571
Type III	F	G	H	F	P	G	G	G	G	G	G	G	G	F	G	G	G	H	30,000	31x4	8,571
Chip Seal																					
PHE - Med. Fine	G	G	H	F	H	G	G	F	F	G	G	H	H	H	P	P	G	P	14,000	31x5	3,500
PHE - Medium	G	G	H	F	H	G	G	F	F	G	G	H	H	H	P	P	G	P	14,000	31x5	3,500
PHA - Medium (See Note 3.)	G	G	H	F	H	G	G	G	G	G	G	H	H	G	P	P	G	P	10,000	41x5	4,000
PHA - Coarse (See Note 3.)	G	G	H	F	H	G	G	G	G	G	G	H	H	G	P	P	G	G	10,000	41x5	4,000
AR - Medium	G	G	H	F	H	G	G	G	G	G	G	H	G	G	P	P	G	P	25,000	41x5	5,200
AR - Coarse	G	G	H	F	H	G	G	G	G	G	G	H	G	G	P	P	G	G	25,000	41x5	5,200
PM Bituminous																					
Conventional OGAC	G	G	P	P	H	G	G	G	G	G	G	G	F	P	G	G	G	P	30,000	31x4	8,571
PDA OGAC	G	G	P	P	H	G	G	G	G	G	G	G	F	P	G	G	G	P	30,000	41x5	5,557
AR OGAC	G	G	P	F	H	G	G	G	G	G	G	G	F	P	G	G	G	P	40,000	41x5	8,000
AR OGAC High Binder (HB)	G	G	P	F	H	G	G	G	G	G	G	G	F	P	G	G	G	P	45,000	41x5	3,000
Gap Graded RACOL	G	G	P	G	F	G	G	G	G	G	G	G	F	F	G	G	G	G	45,000	41x5	3,000
Thin Bedded Wearing Course (BWC)	G	G	P	F	P	G	G	G	G	G	G	G	F	F	G	G	G	G	50,000	41x5	10,000
Wearing Graded ACOL																					
Conventional	G	G	P	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	30,000	21x5	8,571
PDA	G	G	P	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	35,000	31x5	8,750
AR	G	G	P	G	F	G	G	G	G	G	G	G	F	F	G	G	G	G	45,000	41x5	10,000
Slurries	P	P	G	H	G	G	G	G	G	G	G	G	G	G	G	G	G	G	80,000	41x5	25,000

Last revised 3-3-02

G=Good Performance

F=Fair Performance

P=Poor Performance

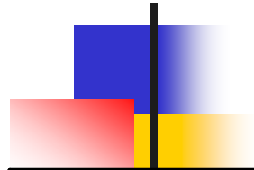
H=Not Recommended

Note: 1. Usually limited to shoulders, low volume roads and parking areas.

Note: 2. Generally used on shoulders, parking areas and locations where less aggressive wear/tear is desired.

Note: 3. Under evaluation. Please consider other strategy at this time.

Maintenance Directive 2004



Treatment	Raveling	Oxidation	Bleeding	Rutting		Urban	Rural
				<1/2"	>1/2"		
Slurry Seals							
Type II (See note 1)	F	G	N	N	N	G	G
Type III	G	G	N	F	N	G	G
Chip Seal							
PME - Med. Fine	G	G	N	F	N	P	G
PME - Medium	G	G	N	F	N	P	G
PMA -Medium (See Note 3.)	G	G	N	F	N	P	G
PMA - Coarse (See Note 3.)	G	G	N	F	N	P	G
AR - Medium	G	G	N	F	N	P	G
AR - Coarse	G	G	N	F	N	P	G

General Guidelines for Effective Treatments on Cracks

● **ATTENTION: 4-22-11**

	Type of Sealing														
	Alligator "A"			Alligator "B"			Alligator "C"			Smooth Road PA Concrete			Other		
Criteria	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
Wear	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	H Material Loss	<10% or >10%	<10% or >10%
Crack Seal	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	<174" or >174"	<174" or >174"	<178" or >178"	H Material Loss	<10% or >10%	<10% or >10%
Sealant															
Conventional Seal (See Note 4)															
Eucasia	H	F	H	H	P	H	H	M	H	G	F	H	G	P	P
Modified (Rubber)	H	G	P	H	P	H	H	P	H	P	G	F	P	P	P
Fog Seal (See note 4)	G	H	H	G	H	H	F	H	H	F	H	H	F	P	P
Rejuvenator (See note 4)	G	H	H	G	H	H	F	H	H	F	H	H	F	P	P
Sanding Seal															
Type II (See note 4)	F	H	H	F	H	H	F	H	H	F	H	H	F	P	P
Type III	F	P	H	F	P	H	F	P	H	F	P	H	F	P	P
MicrosealFining															
Type II (See note 3)	G	H	H	F	P	H	F	P	H	F	H	H	P	P	P
Type III	G	P	H	F	P	H	F	P	H	F	H	H	P	P	P
Chip Seal															
PHE - Med. Fin.	G	P	H	G	F (See Note 4)	H	G	F (See Note 4)	H	F	P	H	F	P	P
PHE - Medium	G	P	H	G	F (See Note 4)	H	G	F (See Note 4)	H	F	P	H	F	P	P
PHA - Medium (See Note 3.)	G	P	P	G	F (See Note 4)	P	G	P (See Note 4)	P	P	P	H	P	P	P
PHA - Coarser (See Note 3.)	G	P	P	G	F (See Note 4)	P	G	P (See Note 4)	P	P	P	H	P	P	P
AR - Medium	G	G	F	G	G	F	G	F (See Note 4)	F	P	F	F	P	P	P
AR - Coarser	G	G	F	G	G	F	G	F (See Note 4)	F	P	F	F	P	P	P
PM Alligation															
Conventional OGAC	G	F	H	G	F (See Note 4)	H	G	F (See Note 4)	H	G	F	F	F	P	P
PBA OGAC	G	F	H	G	F (See Note 4)	H	G	F (See Note 4)	H	G	F	F	F	P	P
AR OGAC	G	G	F	G	G	F (See Note 4)	G	G	F	G	F	P	P	P	P
AR OGAC High Binder (HB)	G	G	F	G	G	F (See Note 4)	G	G	F	G	F	P	F	P	P
Gap Graded RACOL	G	G	G	G	G	F (See Note 4)	G	G	G	G	F	P	G	G	G
This Banded/Wearing Course (BWC)	G	G	G	G	G	F (See Note 4)	G	G	F	F	F	P	P	P	P
Banner Graded RCOL															
Conventional	G	G	F	G	G (See Note 4)	F (See Note 4)	G	G	F	F	F	F	H	F	F
PBA	G	G	G	G	G (See Note 4)	F (See Note 4)	G	G	G	F	F	F	H	F	F
AR	G	F	P	F	P (See Note 4)	P	G	F	P	P	P	F	H	F	F
Rincoala	H	H	F	H	H	G	H	H	G	H	F	F	H	F	G

G - Good Performer F - Fair Performer P - Poor Performer H - Not Recommended

Note: 2. Generally used on shoulders, parking areas and localities where less aggressive surface is desired.

Note: 4. Effluent when proper PrepWork has been performed.

Note: 5. Per Haislman's Manual, Cranks 41/4 inch - Crank Seal Not Recommended.

Maintenance Directive 20004 General Guidelines for Effective Treatments on Cracks

	Alligator "C"			Longitudinal/Transverse		
Criteria	Low	Medium	High	Low	Medium	High
Width	<1/4"	>1/4", <1/2"	>1/2"	<1/4"	>1/4", <1/2"	>1/2"
	or	or	or			
	Area <10%	>10%, <20%	>20%, <30%			
Treatment						
Microsurfacing						
Type II (See note 2)	F	P	N	F	N	N
Type III	F	P	N	F	N	N
PM Alternative						
Conventional OGAC	G	F (See Note 4)	N	G	F	P
PBA OGAC	G	F (See Note 4)	N	G	F	P
AR OGAC	G	G	F	G	F	P
AR OGAC High Binder (HB)	G	G	F	G	F	P
Gap Graded RACOL	G	G	G	G	F	P
Thin Bonded Wearing Course (BWC)	G	G	F	F	F	P



Differences Between Approaches and Recommendations

■ Differences

- the treatment and consideration of cracking.
- a second page added to the Matrix.
- fluctuations in the Costs/Lane-mile and life expectancy of treatments.

■ Recommendations

- As the 2004 MTCE Directive is the current basis for the Contract Maintenance program, its' decision matrix should be the selected version.



LCCA- an Approach to Cost Effectiveness

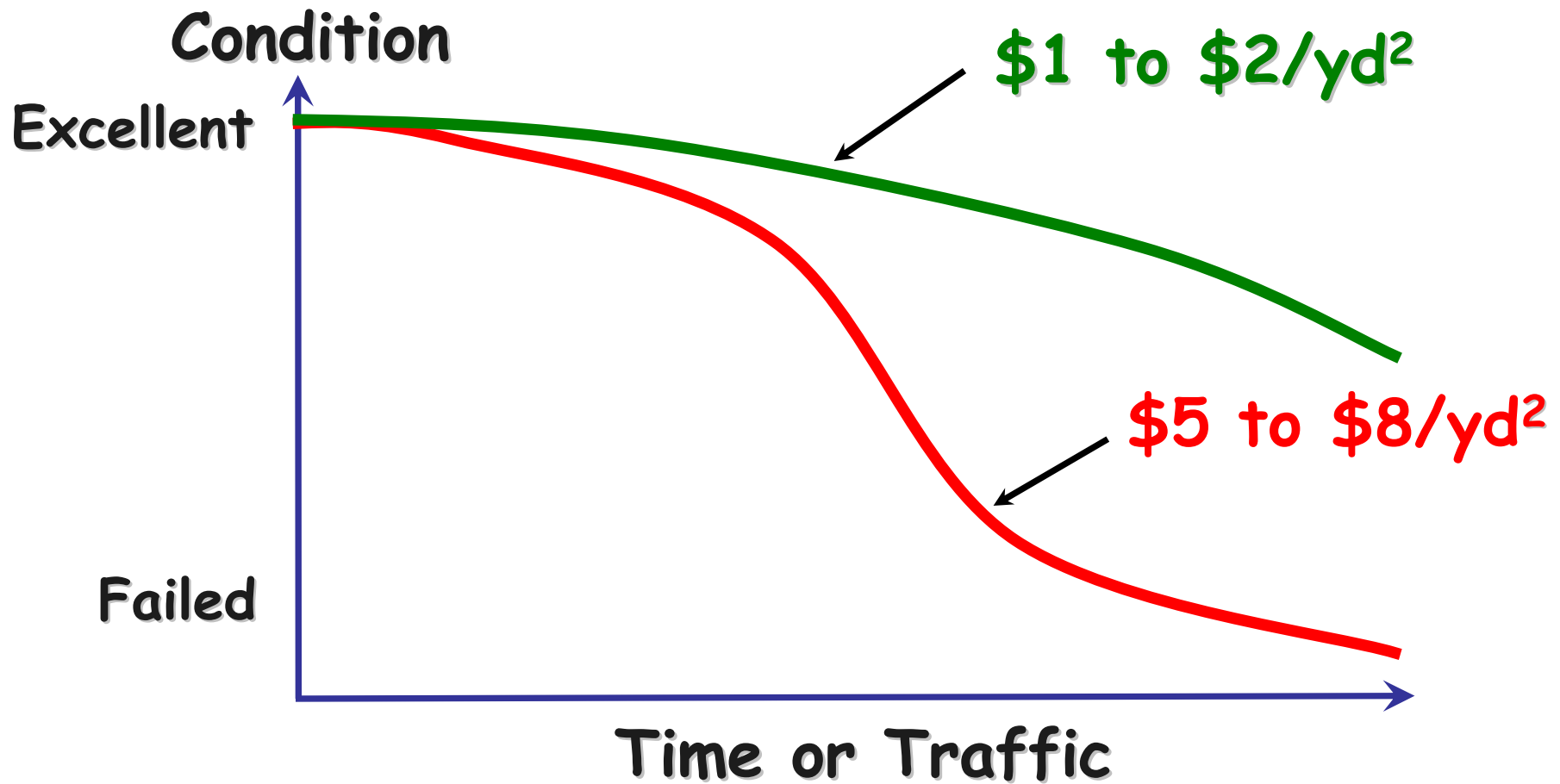
- Definition
- Elements
- Proposed approach
- Expected results



LCCA (Definition)

- Allows comparison of two or more alternatives on a rational economic basis
- Initial and future costs considered together with expected pavement performance

Example of Costs





LCCA Elements for HMA Pavements

- Type and life of Maintenance and rehabilitation treatments
- Agency costs
- User costs (auto repairs, safety, delays)
- Salvage value
- Time value of money (present net value vs. annual cost)



Data Needs

- Determine lives (or life extension) of pavement preservation treatments
- Determine costs of typical maintenance and rehabilitation costs
- In lieu of actual data, use best estimates of life of treatment and life extension



Estimated Life of Treatment

Treatment	Good Condition (PCI=80)	Fair Condition (PCI=60)	Poor Condition (PCI=40)
Fog Seal	3 - 5	1 - 3	1 - 2
Chip Seal	7 - 10	3 - 5	1 - 3
Slurry Seal	7 - 10	3 - 5	1 - 3
Micro- surfacing	8 - 12	5 - 7	2 - 4
Thin HMA	10 - 12	5 - 7	2 - 4



LCCA Analysis Approaches

- LCCA Model can be run in two modes
 - Single best estimates of inputs
 - ◆ Produces single estimate of cost
 - ◆ "Deterministic"
 - Range of estimates for each input
 - ◆ Produces distribution of costs
 - ◆ A means to address uncertainty
 - ◆ "Probabilistic"



Example of Savings Associated with Using PP Treatments

Facility	Alternate	LCC (NPV), \$/sy	% Savings
City Streets	A - Recon	21.08	14.6
	B - PM	18.40	
Rural Highways	A - Recon	36.44	17.0
	B - PM	31.14	
Major Highways	A - Recon	70.80	76.9
	B - PM	40.02	



Summary

- Goals of subgroup
- Work activities
- Approach for selecting treatments
- Approach for performing LCCA
- Training recommendations



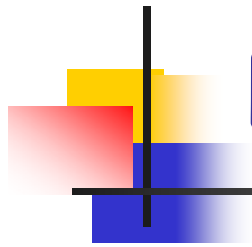
Action items-Treatment Selection

- Treatment selection process for flexible pavements- Draft completed
- Treatment selection process for rigid pavements_To be developed
- Recommended Training based on above



Action items-LCCA

- Cost data for treatments- 3rd Quarter 2005
- Expected life of treatments- 3rd Quarter 2005
- LCCA approach- 3rd Quarter 2005
- Complete initial LCCA studies- Early 2006
- Recommended Training Program - Following completion of above



Recommended Training aids

- **MTAG-FHWA is putting it on the web**
- **Data needs and collection procedures**
- **Treatment Selection process**
- **LCCA approach**

MTAG- www.dot.ca.gov/hq/maint/MTA_guide.htm

Questions?

